Code: IIND-05/A **Credits: 9**
Matter: Mechanical Plants
Main language of instruction: Italian
Other language of instruction: English

Teaching Staff

Head instructor
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Introduction

Industrial Mechanical Plants include all complex systems for the production of goods and services, necessary for the correct development of production processes. These plants are present not only in the production industry, but also in the tertiary and craft sector.
Considering the complexity, the variety but also the number of different industrial technologies that mechanical systems can use, in this course we want to address all the peculiar elements for the planning, implementation and management phases, with a systemic approach and applicability.
The purpose of this course is to provide to the student the knowledge of the theoretical principles, the general schemes of operation, the adoption of the components, the design method and technical-economic optimization as well as the references to the main rules and regulations.

Objectives

The course of Mechanical Plants has the following educational objectives:

1. Providing a comprehensive overview of mechanical and service facilities for the industry;
2. Providing the ability to understand the graphic representations of the various parts of a plant in the executive design phase;
3. Recalling the basic concepts of fluid machines;
4. Illustrating the components of the fluid networks and the sizing of the pipes;
5. Illustrating the characteristics of the steam distribution systems: sizing and selection of the machines;
6. Illustrating the industrial processes that require thermal and electrical energy: cogeneration plants;
7. Illustrating the characteristics of fire-fighting systems: systems and legislative framework.

Competencies:

Knowledge and understanding ability
At the end of the course, the student will demonstrate the knowledge of several principles, with the ability to calculate the size of the main mechanical systems for production systems service, that are: water systems, compressed air distribution systems and fire service systems. In particular, the student will acquire the skills necessary to understand

the patterns of the different systems and the symbols used, in a comprehensive and systematic manner. Finally, the student will know the various types of cogeneration plants and of technological steam production and distribution, having the required ability in choosing the type and size of the plant for the specific user.

Application of knowledge

The student will be able to calculate the size of main machines in different plants, in particular for water systems, which are always present in all production systems, will be able to choose the operating pressures and use the tables for sizing the diameters in operation flow rates and thermal insulation required. Furthermore, the student will be able to read the daily water demand diagrams and, through the drawing of the integral consumption curve, to determine the minimum volume of the compensation tank. It will also be able to choose the boilers and calculate the size of the nets for the distribution of technological steam. E-Tivity also provides for the application of theoretical knowledge to practical problems to be solved in the context of the choice of machines and the sizing of networks.

Ability to draw conclusions

As part of the sizing of mechanical systems, the student will be able to understand and choose general needs, as well as the most appropriate method. In particular, the student will be able to understand the drawings and the layouts of the plant, in addition to knowing how to modify the assets to optimally serve the various users based on their location and needs. At the same time, it will be able to move in the current regulatory context, in order to choose appropriate solutions to the project specifications.

Communication skills

The student will acquire a complete picture of the plant reality, being able to prefigure and interpret the reality of the production systems, in which many engineers will go to work or with whom they will have to confront in activity of business consultancy or engineering.

Ability to learn

The student will have a perfect plant mentality, raising awareness of the complex problems of industrial plants and sizing and optimization problems for plant systems. Furthermore, the student will gain awareness of the dynamics of company realities and production systems.

Syllabus

Programme of the course:

Subject 1 - Introduction to mechanical service plants for industry

In this Module the following topics are addressed: the aims of the course; the general description of mechanical systems: that is, the different types and how the systems themselves are inserted into the production system, the possible classifications. Considerations on the design of mechanical service systems: economic, regulatory, reliability and maintenance criteria.

Subject 2 - Fluid distribution systems: symbols, types, tubes

In this Module the following topics are addressed: how to identify networks, symbology and network representation. Piping: commonly used materials compatible with the design requirements. Detailed study on steel, cast iron, copper and plastic pipes, in addition to the most innovative ones in glass fiber reinforced resin

Subject 3 - Network connections, positioning and isolation

In this Module the following topics are dealt with: the elements necessary to connect the pipes in the networks, i.e. connections, junctions and interception devices, classification and selection criteria. Positioning and placement of pipes within industrial buildings. Pipe linings and insulation and compensation for thermal expansion.

Subject 4 - Thermal insulation sizing

In this Module the following topics are covered: calculation of the minimum insulation thickness for a pipe run by cold fluid, calculation of the "economic" thickness of the insulation, protection against dripping.

Subject 5 - Water distribution networks

In this Module the following topics are addressed: the water supply for industrial uses, the criteria for the sizing of the water system, the sizing of the water system without a compensation tank, the sizing of the water system with a compensation tank. In addition: the economic convenience of the compensation tank, autoclave system, distribution network sizing, load losses.

Subject 6 - Compressed air distribution networks

In this Module the following topics are dealt with: general information on compressed air, compressors, compressed air drying, distribution networks, pipeline layout, air speed in the pipes, load losses.

Subject 7 - Fire service systems

In this Module the following topics are addressed: general information on fire prevention systems, legislative compliance, fire characteristics, fire protection and prevention, detection systems, fixed and mobile extinguishing systems.

Subject 8 - Steam distribution steam plants

In this Module the following topics are covered: the scheme of the plant for the production and distribution of technological steam and representation of the thermodynamic cycle on the TS diagram, choice of the steam generator, sizing of the system, the regulation organs, sizing of condensate networks, condensate discharge and arresters.

E-tivity 1 - "Study of the relevant legislation"

E-tivity 2 - "Plant design"

Subject 9 - Electrical and thermal energy cogeneration plants

In this Module the following topics are addressed: the total recovery electric and thermal cogeneration plant, the schemes of alternative plants with total recovery, example of self-production of electric and thermal energy.

Evaluation system and criteria

The exam consists in a written test aimed at ascertaining the abilities to analyze and re-elaborate the concepts acquired and a series of interactive activities (E-Tivity).

Etivities are evaluated from 0 to 2 points, is carried out, during the course. The exam is evaluated for the remaining 0 to 28 points and can be done in written form both at the Rome office and at the educational poles upon booking by the student.

The written test can include both numerical exercises and different theory questions to be carried out in 90 minutes. The exercises present in the exam will concern the most applicative modules present in the platform.

Failure to deliver the E-Tivity before the written test will result in the application of a null vote in the final vote count.

The expected learning outcomes regarding the knowledge and understanding of the subject and the ability to apply them are assessed by the written test, while the communication skills and self-learning ability are assessed in progress mainly through the E-Tivity. Finally, the ability to draw conclusions is evaluated both in the performance of the written test and in the development of E-Tivity.

During the exam is not possible to use books or lecture notes. Tables necessary for the resolution of the exercises are provided by the teacher.

Bibliography and resources

Materials to consult:

Teaching material

The educational material on the platform is divided into 9 modules. They entirely cover the program of the Mechanical Equipment course and for each of them have been developed lecture notes and video lessons, in which there are slides with comments of the teacher. Teaching material covers all the exam program.

Books:

A. Pareschi - "Impianti meccanici per l'industria", Esculapio (2012);

A. Pareschi - "Esercizi e progetti di impianti meccanici", Esculapio (2012);